Claims

1. A fluid control valve comprising:

a valve seat (110);

a flow path through said valve seat

a diaphragm (108);

a normally closed pneumatic actuator (118);

a valve control chamber (114);

a pneumatic feed line (116); and

a pilot valve (144);

wherein said diaphragm is dispersed between said valve seat and said valve control chamber;

said normally closed pneumatic actuator is configured to normally close said flow path by deflecting said diaphragm to seal over said valve seat;

said pneumatic feed line is in fluidic communication with said normally closed pneumatic actuator;

said pneumatic feed line is in fluidic communication with said pilot valve; and

said pilot valve is in fluidic communication with said valve control chamber.

2. The fluid control valve as in claim 1 wherein said pilot valve is a three way normally open valve;

said control chamber communicates with said pneumatic feed line through said pilot valve when said pilot valve is not actuated;

said control chamber is disconnected from said pneumatic feed line by said pilot valve when said pilot valve is actuated; and

said control chamber communicates with a vent line through said pilot valve when said pilot valve is actuated.

3. The fluid control valve as in claim 2 wherein said pilot valve is a solenoid valve.

4. The fluid control valve as in claim 2 wherein said vent line is evacuated.

5. The fluid control valve as in claim 1 wherein said diaphragm is a dome-shaped metallic diaphragm.

6. The fluid control valve as in claim 5 wherein said diaphragm is mounted with a preset deformation;

said preset deformation is directed outwards across from said valve seat; and

said diaphragm is fastened while under deformation.

7. The fluid control valve as in claim 6 wherein said deformation is reproducibly applied by reproducibly pressurizing said diaphragm from the side of said valve seat;

said diaphragm is placed between a sealing ledge within said valve seat and a corresponding bonnet;

said diaphragm is lightly secured between said sealing ledge and said corresponding bonnet to maintain sufficient fluidic flow restriction;

said sufficient flow restriction enables said reproducibly pressurizing said diaphragm; and

said diaphragm is tightly secured between said sealing ledge and said corresponding bonnet under said reproducibly pressurizing conditions.

8. The fluid control valve as in claim 7 wherein said reproducibly pressurizing means that the pressure is applied with full range repeatability of better than 10%.

9. The fluid control valve as in claim 7 wherein said reproducibly pressurizing comprises applying ultrahigh purity nitrogen at pressure in the range from 45-150 psig.

10. The fluid control valve as in claim 1 wherein said pneumatic actuator includes a stem;

said stem penetrates through the wall of said valve control chamber; and

a sliding seal is dispersed between said stem and said wall of said valve control chamber.

11. The fluid control valve as in claim 1 wherein the volume of said valve control chamber is less than 2 cubic centimeters.

12. The fluid control valve as in claim 1 wherein said diaphragm is rippled.

13. The fluid control valve as in claim 2 wherein said fluid feed line is supplied with pressurized fluid;

said pressurized fluid actuates said normally closed pneumatic actuator;

said actuated pneumatic actuator is repelled away from said diaphragm;

said pressurized fluid is connected into said valve control chamber when said pilot valve is not actuated;

said diaphragm is deflected to seal over said valve seat by said pressurized fluid; and

said connected means connected in serial fluidic communication.

14. The fluid control valve as in claim 2 wherein said fluid feed line is supplied with pressurized fluid;

said pressurized fluid actuates said normally closed pneumatic actuator;

said actuated pneumatic actuator is repelled away from said diaphragm;

said pressurized fluid is disconnected from said valve control chamber when said pilot valve is actuated;

said control chamber is vented when said pilot valve is actuated; and

said diaphragm is flexibly snapped away from said valve seat to enable flow through said fluid control valve.

15. The fluid control valve as in claim 13 wherein said pressurized fluid is supplied to said fluid feed line from a solenoid valve bank.

16. The fluid control valve as in claim 6 wherein said fluid feed line is supplied with pressurized fluid;

said pressurized fluid actuates said normally closed pneumatic actuator;

said actuated pneumatic actuator is repelled away from said diaphragm;

said pressurized fluid is connected into said valve control chamber when said pilot valve is not actuated;

said diaphragm is deflected to seal over said valve seat by said pressurized fluid and

said connected means connected in serial fluidic communication.

17. The fluid control valve as in claim 6 wherein said fluid feed line is supplied with pressurized fluid;

said pressurized fluid actuates said normally closed pneumatic actuator;

said actuated pneumatic actuator is repelled away from said diaphragm;

said pressurized fluid is disconnected from said valve control chamber when said pilot valve is actuated;

said control chamber is vented when said pilot valve is actuated; and

said diaphragm is flexibly snapped away from said valve seat to enable flow through said fluid control valve.

18. The fluid control valve as in claim 12 wherein said fluid feed line is supplied with pressurized fluid;

said pressurized fluid actuates said normally closed pneumatic actuator;

said actuated pneumatic actuator is repelled away from said diaphragm;

said pressurized fluid is connected into said valve control chamber when said pilot valve is not actuated; and

said diaphragm is deflected to seal over said valve seat by said pressurized fluid.

19. The fluid control valve as in claim 12 wherein said fluid feed line is supplied with pressurized fluid;

said pressurized fluid actuates said normally closed pneumatic actuator;

said actuated pneumatic actuator is repelled away from said diaphragm;

said pressurized fluid is disconnected from said valve control chamber when said pilot valve is actuated;

said control chamber is vented when said pilot valve is actuated; and

said diaphragm is flexibly snapped away from said valve seat to enable flow through said fluid control valve.

20. The fluid control valve as in claim 1 wherein said fluid feed line is supplied with pressurized fluid;

said pressurized fluid actuates said normally closed pneumatic actuator;

said actuated pneumatic actuator is repelled away from said diaphragm;

said pressurized fluid is connected into said valve control chamber when said pilot valve is not actuated; and

said diaphragm is deflected to seal over said valve seat by said pressurized fluid.

21. The fluid control valve as in claim 1 wherein said fluid feed line is supplied with pressurized fluid;

said pressurized fluid actuates said normally closed pneumatic actuator;

said actuated pneumatic actuator is repelled away from said diaphragm;

said pressurized fluid is disconnected from said valve control chamber when said pilot valve is actuated

said control chamber is vented when said pilot valve is actuated; and

said diaphragm is flexibly snapped away from said valve seat to enable flow through said fluid control valve.

22. The fluid control valve as in claim 14 wherein the response time of said enabled said flow through said fluid control valve is substantially similar to the response time of said pilot valve.

23. The fluid control valve as in claim 22 wherein said response time is shorter than 2 (two) milliseconds.

24. The fluid control valve as in claim 22 wherein said response time is shorter than 1 (one) millisecond.

25. The fluid control valve as in claim 22 wherein said response time is shorter than 0.5 (half) a millisecond.

26. The fluid control valve as in claim 2 wherein fluid feed line is supplied with pressurized fluid;

said pressurized fluid actuates said normally closed pneumatic actuator;

said actuated pneumatic actuator is repelled away from said diaphragm;

said pressurized fluid is initially disconnected from said valve control chamber when said pilot valve is actuated;

said flow is initially enabled through said fluid control valve;

said pressurized fluid is connected to said valve control chamber when said pilot valve is de-actuated; and

said flow through said fluid control valve is disabled.

27. The fluid control valve as in claim 26 wherein the response time of said disabled said flow through said fluid control valve is substantially similar to the response time of said pilot valve.

28. The fluid control valve as in claim 26 wherein said response time is shorter than 2 (two) milliseconds.

29. The fluid control valve as in claim 26 wherein said response time is shorter than 1 (one) millisecond.

30. The fluid control valve as in claim 26 wherein said response time is shorter than 0.5 (half) a millisecond.

31. The fluid control valve as in claim 2 wherein said fluid feed line is vented from said pressurized fluid;

said normally closed pneumatic actuator returns into normally closed position; and

said normally closed pneumatic actuator at said normally closed position disables said flow through said fluid control valve.

32. The fluid control valve as in claim 31 wherein said fluid feed line is vented is controlled through a solenoid valve bank.

33. The fluid control valve as in claim 31 wherein said fluid feed line vented is triggered by a pressure loss.

34. The fluid control valve as in claim 33 wherein said pressure loss is triggered by a failure.

35. The fluid control valve as in claim 14 wherein said pneumatic actuator is repelled away from said diaphragm to create a restricted gap;

said restricted gap is smaller than the full extension of said diaphragm; and

said restricted gap is externally adjustable by externally adjusting the travel of said pneumatic actuator when said pneumatic actuator is actuated; and

the conductance of said fluid control valve is determined by said restricted gap said smaller than said full extension of said diaphragm.

36. The fluid control valve as in claim 17 wherein said pneumatic actuator is repelled away from said diaphragm to create a restricted gap;

said restricted gap is smaller than the full extension of said diaphragm;

said restricted gap is externally adjustable by externally adjusting the travel of said pneumatic actuator when said pneumatic actuator is actuated; and

the conductance of said fluid control valve is determined by said restricted gap said smaller than said full extension of said diaphragm.

37. The fluid control valve as in claim 19 wherein said pneumatic actuator is repelled away from said diaphragm to create a restricted gap;

said restricted gap is smaller than the full extension of said diaphragm;

said restricted gap is externally adjustable by externally adjusting the travel of said pneumatic actuator when said pneumatic actuator is actuated; and

the conductance of said fluid control valve is determined by said restricted gap said smaller than said full extension of said diaphragm.

38. The fluid control valve as in claim 21 wherein said pneumatic actuator is repelled away from said diaphragm to create a restricted gap;

said restricted gap is smaller than the full extension of said diaphragm;

said restricted gap is externally adjustable by externally adjusting the travel of said pneumatic actuator when said pneumatic actuator is actuated; and

the conductance of said fluid control valve is determined by said restricted gap said smaller than said full extension of said diaphragm.

39. The fluid control valve of claim 1 wherein said valve seat includes a valve seal wherein said seal is made from an elastomer.

40. The fluid control valve of claim 39 wherein said elastomer is coated by a thin layer of polymer.

41. The fluid control valve of claim 40 wherein said seal is plated with a thin layer of metal.

42. The fluid control valve of claim 41 wherein said seal is placed within a corresponding valve seat and said seat, including said seal are plated with thin film of metal.

43. The fluid control valve of claim 2 wherein said fluid control comprises controlling the pulsed delivery of gas into an ALD process apparatus.

44. The fluid control valve of claim 26 wherein said fluid control comprises controlling the pulsed delivery of gas into an ALD process apparatus.

45. The fluid control valve of claim 14 wherein said fluid control comprises controlling the pulsed delivery of gas into an ALD process apparatus.

46. A fluid control valve comprising:

a valve seat;

a flow path through said valve seat;

a metallic bellow;

a normally closed pneumatic actuator;

a valve control chamber;

a pneumatic feed line; and

a pilot valve;

wherein said metallic bellow is dispersed between said valve seat and said valve control chamber;

said metallic bellow seals between said valve seat and said valve control chamber;

said seals between said valve seat and valve control chamber comprising mounting first end of said bellow between said valve seat and said valve control chamber and enclosing second end of said bellow with a substantially flat disc;

said normally closed pneumatic actuator is configured to normally close said flow path by deflecting said disc on said second end of said bellow to seal over said valve seat;

said pneumatic feed line is connected in serial fluidic communication with said normally closed pneumatic actuator; and

said pneumatic feed line is connected in serial fluidic communication with said pilot valve and said pilot valve is connected in serial fluidic communication with said valve control chamber

47. The fluid control valve as in claim 46 wherein said pilot valve is a three-way normally open valve;

said control chamber is communicated with said pneumatic feed line through said pilot valve when said pilot valve is not actuated;

said control chamber is disconnected from said pneumatic feed line by said pilot valve when said pilot valve is actuated

said connected means connected in serial fluidic communication; and

said control chamber is communicated to a vent line through said pilot valve when said pilot valve is actuated.

48. The fluid control valve as in claim 47 wherein said pilot valve is a solenoid valve.

49. The fluid control valve as in claim 47 wherein said vent line is evacuated.

50. The fluid control valve as in claim 46 wherein said bellow is an electroformed metallic bellow.

51. The fluid control valve as in claim 46 wherein said bellow is an hydroformed metallic bellow.

52. The fluid control valve as in claim 46 wherein said bellow is a welded metallic bellow and said fluid control valve includes further a spring 912 to maintain said welded metallic bellow at a preset compressed position.

53. The fluid control valve as in claim 46 wherein said pneumatic actuator includes a stem;

said stem penetrates through the wall of said valve control chamber; and

a sliding seal is dispersed between said stem and said wall of said valve control chamber.

54. The fluid control valve as in claim 46 wherein the volume of said valve control chamber is less than 2 cubic centimeters.

55. The fluid control valve as in claim 47 wherein said fluid feed line is supplied with pressurized fluid;

said pressurized fluid actuates said normally closed pneumatic actuator;

said actuated pneumatic actuator is repelled away from said bellow;

said pressurized fluid is connected into said valve control chamber when said pilot valve is not actuated; and

said bellow is deflected to seal said disc over said valve seat by said pressurized fluid.

56. The fluid control valve as in claim 47 wherein said fluid feed line is supplied with pressurized fluid;

said pressurized fluid actuates said normally closed pneumatic actuator;

said actuated pneumatic actuator is repelled away from said bellow;

said pressurized fluid is disconnected from said valve control chamber when said pilot valve is actuated;

said control chamber is vented when said pilot valve is actuated; and

said bellow is flexibly snapped away from said valve seat to enable flow through said fluid control valve.

57. The fluid control valve as in claim 55 wherein said pressurized fluid is supplied to said fluid feed line from a solenoid valve bank.

58. The fluid control valve as in claim 56 wherein the response time of said enabled said flow through said fluid control valve is substantially similar to the response time of said pilot valve.

59. The fluid control valve as in claim 58 wherein said response time is shorter than 4 (four) milliseconds.

60. The fluid control valve as in claim 58 wherein said response time is shorter than 2 (two) milliseconds.

61. The fluid control valve as in claim 58 wherein said response time is shorter than 1 (one) millisecond.

62. The fluid control valve as in claim 47 wherein fluid feed line is supplied with pressurized fluid;

said pressurized fluid actuates said normally closed pneumatic actuator;

said actuated pneumatic actuator is repelled away from said bellow;

said pressurized fluid is initially disconnected from said valve control chamber when said pilot valve is actuated;

said flow is initially enabled through said fluid control valve; and

said pressurized fluid is connected to said valve control chamber when said pilot valve is de-actuated; and

said flow through said fluid control valve is disabled.

63. The fluid control valve as in claim 62 wherein the response time of said disabled said flow through said fluid control valve is substantially similar to the response time of said pilot valve.

64. The fluid control valve as in claim 62 wherein said response time is shorter than 4 (four) milliseconds.

65. The fluid control valve as in claim 62 wherein said response time is shorter than 2 (two) milliseconds.

66. The fluid control valve as in claim 62 wherein said response time is shorter than 1 (one) millisecond.

67. The fluid control valve as in claim 47 wherein said fluid feed line is vented from said pressurized fluid;

said normally closed pneumatic actuator returns into normally closed position; and

said normally closed pneumatic actuator at said normally closed position disables said flow through said fluid control valve.

68. The fluid control valve as in claim 67 wherein said fluid feed line vented is controlled through a solenoid valve bank.

69. The fluid control valve as in claim 67 wherein said fluid feed line vented is triggered by a pressure loss.

70. The fluid control valve as in claim 69 wherein said pressure loss is triggered by a failure.

71. The fluid control valve as in claim 56 wherein said pneumatic actuator is repelled away from said bellow to create a restricted gap;

said restricted gap is smaller than the full compression of said bellow;

said restricted gap is externally adjustable by externally adjusting the travel of said pneumatic actuator when said pneumatic actuator is actuated; and

the conductance of said fluid control valve is determined by said restricted gap said smaller than said full compression of said bellow.

72. The fluid control valve of claim 46 wherein said valve seat includes a valve seal wherein said seal is made from an elastomer.

73. The fluid control valve of claim 72 wherein said elastomer is coated by a thin layer of polymer.

74. The fluid control valve of claim 73 wherein said seal is plated with a thin layer of metal.

75. The fluid control valve of claim 73 wherein said seal is placed within a corresponding valve seat and said seat, including said seal are plated with thin film of metal.

76. The fluid control valve of claim 47 wherein said fluid control comprises controlling the pulsed delivery of gas into an ALD process apparatus.

77. The fluid control valve of claim 62 wherein said fluid control comprises controlling the pulsed delivery of gas into an ALD process apparatus.

78. The fluid control valve of claim 56 wherein said fluid control comprises controlling the pulsed delivery of gas into an ALD process apparatus.

79. A fluid control valve, comprising:

a valve body wherein an inlet and an outlet ports are formed;

a valve camber bottom portion formed in said valve body wherein a first of said ports is connected in serial fluidic communication into said valve bottom portion substantially at the center of said valve chamber bottom portion;

a second of said ports is connected in serial fluidic communication into said valve bottom portion substantially off the center of said valve chamber bottom portion;

a valve seal is located inside said valve chamber bottom around said first port;

a valve chamber top portion made from a substantially flexible member;

the center of said substantially flexible member is normally positioned substantially separated from said valve chamber bottom portion;

said valve chamber top separates said valve chamber from a valve control chamber;

said valve control chamber comprises a fluid connection port;

said valve control chamber comprises a translatable stem;

said translatable stem is actuated by pressurized fluid means through a fluid feed line;

said fluid connection port is connected in serial fluidic communication with said fluid feed line;

a pilot control valve is connected in serial fluidic communication between said fluid feed line and said fluid connection port;

the fluid path in said pilot control valve normally connects the fluid from said fluid feed line to said fluid connection port;

said fluid path in said pilot valve disconnects the fluid from said fluid feed line to fluid connection port when actuated and connects said fluid connection port to a vent line when actuated;

said valve stem is normally compressed with a spring to push and deflect said flexible member between said valve chamber and said control chamber to conform and substantially seal over said valve seal; whrein

a fluid is applied through fluid feed line to actuate said valve stem to translate away from said flexible member between said valve chamber and said control chamber;

said fluid is applied into said valve control chamber through said pilot valve when said pilot valve is not actuated to deflect said flexible member between said valve chamber and said control chamber to conform and substantially seal over said valve seal;

said fluid is vented out of said valve control chamber when said pilot valve is actuated;

said flexible member returns to a free-standing position when said pilot valve is actuated; and

said fluid control valve is open.

80. The fluid control valve of claim 79 wherein said pilot valve is a solenoid valve.

81. The fluid control valve of claim 79 wherein said flexible member is a dome-shaped diaphragm.

82. The fluid control valve of claim 81 wherein said dome-shaped diaphragm is reinforced at the perimeter.

83. The fluid control valve of claim 82 wherein said reinforced at the perimeter comprising mounting said diaphragm under pressurizing deflection; and

said pressurizing deflection is applied from the concave side of said diaphragm.

84. The fluid control valve of claim 79 wherein said flexible member comprising a metallic bellow.

85. The fluid control valve of claim 79 wherein said flexible member comprising a metallic bellow;

said metallic bellow is assembled with a return spring 912

said return spring 912 maintains said bellow in a substantially compressed form;

said bellow and said return spring 912 are fastened together as a bellow-spring assembly; and

said fluid control valve is open when said bellow-spring assembly is at the free standing form.

86. A valve seat assembly comprising:

a perimeter seal having sealing surface at the top and a protruding ledge located substantially at the bottom;

a groove having dimensions to conformally receive said ledge and lower portion of said seal;

said seal located in said groove.

87. The valve seat assembly as in claim 86 wherein said perimeter seal comprises a core elastomer body and a thin polymer coating.

88. The valve seat assembly of claim 86 wherein said perimeter seal comprises a core elastomer body, a thin polymer coating, and a plated metal film conformally covering the surface of said radial seal;

89. A method mounting a valve seat comprising:

forming a perimeter elastomer seal having a substantially circular cross-section on the top and a protruding mounting ledge on the bottom;

forming in said valve seat a perimeter groove corresponding to said mounting ledge of said perimeter seal; and

bonding said perimeter seal to said perimeter groove.

90. A method as in claim 89 and further comprising coating said perimeter seal with a thin layer of polymer.

91. A method as in claim 89 wherein bonding comprises:

coating said perimeter seal with a thin layer of polymer;

activating the surface of said thin layer of polymer for electroless plating;

coat said perimeter seal with a thin layer of metal using electroless plating or a combination of electroless plating and electroplating;

placing said perimeter seal into said perimeter groove; and

plating said valve seat with a thin layer of metal that conforms to the surface of said perimeter seal and said valve seat.

92. A method for mounting a valve seat as in claim 91 wherein said metal film is nickel.

93. A method for mounting a valve seat as in claim 91 wherein said metal film is a nickel alloy.

94. A fluid control valve comprising:

a valve seat;

a flow path through said valve seat

a metallic diaphragm;

a normally closed pneumatic actuator;

a valve control chamber;

a pneumatic feed line; and

a pilot valve;

wherein said diaphragm is dispersed between said valve seat and said valve control chamber;

said normally closed pneumatic actuator is configured to normally close said diaphragm;

said pneumatic feed line is connected in serial fluidic communication with said normally closed pneumatic actuator;

said pneumatic feed line is connected in serial fluidic communication with said pilot valve and said pilot valve is connected in serial fluidic communication with said valve control chamber;

said control valve is formed on the wall of a gas distribution space;

said valve seat defines a flow outlet from said fluid control valve; and

said flow outlet from said fluid control valve is substantially coplanar with the wall of said gas distribution chamber.

95. A fluid control valve comprising:

a valve seat;

a flow path through said valve seat

a metallic bellow;

a normally closed pneumatic actuator;

a valve control chamber;

a pneumatic feed line; and

a pilot valve;

wherein said metallic bellow is dispersed between said valve seat and said valve control chamber;

said metallic bellow seals between said valve seat and said valve control chamber;

said seals between said valve seat and valve control chamber comprising mounting first end of said bellow between said valve seat and said valve control chamber and enclosing second end of said bellow with a substantially flat disc;

said normally closed pneumatic actuator is configured to normally close said fluid control valve by deflecting said disc on said second end of said bellow to seal over said valve seat;

said pneumatic feed line is connected in serial fluidic communication with said normally closed pneumatic actuator;

said pneumatic feed line is connected in serial fluidic communication with said pilot valve and said pilot valve is connected in serial fluidic communication with said valve control chamber;

said control valve is formed on the wall of a gas distribution space;

said valve seat defines a flow outlet from said fluid control valve; and

said flow outlet from said fluid control valve is substantially coplanar with the wall of said gas distribution chamber.

96. A fail-safe normally closed (FSNC) pneumatically actuated valve with less than 5 msec time response.

97. A fail-safe normally closed (FSNC) pneumatically actuated valve with less than 2 msec time response.

98. A fail-safe normally closed (FSNC) pneumatically actuated valve with less than 1 msec time response.

99. A fail-safe normally closed (FSNC) pneumatically actuated valve with less than 0.5 msec time response.

100. A fail-safe normally closed (FSNC) pneumatically actuated valve with less than 2 msec time response and conductance larger than $C_v = 0.5$.

101. A fail-safe normally closed (FSNC) pneumatically actuated valve with less than 2 msec time response and conductance larger than $C_v = 1$.

102. A fail-safe normally closed (FSNC) pneumatically actuated valve with less than 2 msec time response and conductance larger than $C_v = 2$.

103. A fail-safe normally closed (FSNC) pneumatically actuated valve with less than 5 msec time response and conductance larger than $C_v = 5$.

104. A fail-safe normally closed (FSNC) pneumatically actuated valve with less than 2 msec time response and conductance larger than $C_v = 5$.

105. A high purity fail-safe normally closed (FSNC) pneumatically actuated valve with less than 2 msec time response and operation temperature higher than 150°C.

106. A high purity fail-safe normally closed (FSNC) pneumatically actuated valve with less than 2 msec time response and operation temperature higher than 200°C.

107. A high purity fail-safe normally closed (FSNC) pneumatically actuated valve with less than 2 msec time response and operation temperature higher than 250°C.

108. A high purity fail-safe normally closed (FSNC) pneumatically actuated valve with less than 2 msec time response and operation temperature higher than 300°C.

109. A high purity fail-safe normally closed (FSNC) pneumatically actuated valve with less than 2 msec time response conductance of C_v larger than 0.5 and operation temperature higher than 150°C.

110. A high purity fail-safe normally closed (FSNC) pneumatically actuated valve with less than 2 msec time response conductance of C_v larger than 0.5 and operation temperature higher than 200°C.

111. A high purity fail-safe normally closed (FSNC) pneumatically actuated valve with less than 2 msec time response conductance of C_v larger than 0.5 and operation temperature higher than 250°C.

112. A high purity fail-safe normally closed (FSNC) pneumatically actuated valve with less than 2 msec time response conductance of C_v larger than 0.5 and operation temperature higher than 300°C.

113. The fluid control valve of claim 1 wherein the weight of said metallic diaphragm is less than 0.5 grams.

114. The fluid control valve of claim 46 wherein the weight of said metallic bellow is less than 2 grams.

115. The fluid control valve of claim 46 wherein the weight of said metallic bellow is less than 1 gram.

116. The fluid control valve of claim 46 wherein the weight of said metallic bellow is less than 0.5 gram.

117. The fluid control valve of claim 46 wherein said metallic bellow is electroformed with a multi-layer construction.

118. A method of mounting a valve seat comprising:

electroforming a perimeter seal having a substantially circular cross-section on the top and a perimeter opening at the bottom;

forming a perimeter groove in said valve seat, said perimeter groove having a perimeter corner corresponding to said perimeter opening at the bottom of said perimeter seal;

brazing said perimeter seal into said perimeter groove;

plating said valve seat with a thin layer of metal conforming to the surface of said perimeter seal and said valve seat.

119. A method for preparing and mounting a valve seat comprising:

electroforming a perimeter seal;

said perimeter seal has a substantially circular cross-section on the top;

said perimeter seal has a perimeter opening at the bottom;

forming a perimeter groove in the valve seat;

said perimeter groove has a perimeter corner;

said perimeter corner corresponds to the perimeter opening at the bottom of said perimeter seal;

placing said perimeter seal into said perimeter groove;

control the pressure of an ambient gas within a brazing furnace;

brazing said perimeter seal into said perimeter groove wherein a pre-set pressure of gas is entrapped within said perimeter seal;

plating said valve seat with a thin layer of metal; and

said thin layer of metal conforms to the surface of said perimeter seal and said valve seat.

120. A method for preparing and mounting a valve seat comprising:

electroforming a radial seal;

said radial seal has a substantially circular cross-section on the top;

said radial seal has a radial opening at the bottom;

said radial opening has radial ledges appropriately shaped for electron beam welding;

forming a radial groove in the valve seat;

said radial groove has a radial corner;

said radial corner corresponds to the radial opening at the bottom of said radial seal;

said radial corner is appropriately shaped for electron beam welding;

placing said radial seal into said radial groove;

welding said radial seal into said radial groove using electron beam welding or similar means;

plating said valve seat with a thin layer of metal; and

said thin layer of metal conforms to the surface of said radial seal and said valve seat.

121. A fail-safe normally closed (FSNC) pneumatically actuated valve with response time of less than 5 msec and cycle lifetime exceeding 10 million cycles at less than 100 msec valve cycle time.

122. A fail-safe normally closed (FSNC) pneumatically actuated valve with response time of less than 2 msec and cycle lifetime exceeding 10 million cycles at less than 100 msec valve cycle time.

123. A fail-safe normally closed (FSNC) pneumatically actuated valve with response time of less than 1 msec and cycle lifetime exceeding 10 million cycles at less than 100 msec valve cycle time.

124. A fail-safe normally closed (FSNC) pneumatically actuated valve with response time of less than 5 msec and cycle lifetime exceeding 10 million cycles at less than 100 msec valve cycle time at operating temperature in excess of 150°C.

125. A fail-safe normally closed (FSNC) pneumatically actuated valve with response time of less than 2 msec and cycle lifetime exceeding 10 million cycles at less than 100 msec valve cycle time at operating temperature in excess of 150°C.

126. A fail-safe normally closed (FSNC) pneumatically actuated valve with response time of less than 5 msec, conductance of C_v exceeding 0.5 and cycle lifetime exceeding 10 million cycles at less than 100 msec.

127. A fail-safe normally closed (FSNC) pneumatically actuated valve with response time of less than 5 msec, conductance of C_v exceeding 1 and cycle lifetime exceeding 10 million cycles at less than 100 msec.

128. A fail-safe normally closed (FSNC) pneumatically actuated valve with response time of less than 5 msec, conductance of C_v exceeding 2 and cycle lifetime exceeding 10 million cycles at less than 100 msec.

129. A fail-safe normally closed (FSNC) pneumatically actuated valve with response time of less than 5 msec, conductance of C_v exceeding 0.5 and cycle lifetime exceeding 10 million cycles at less than 100 msec at operating temperature in excess of 150°C.

130. A fail-safe normally closed (FSNC) pneumatically actuated valve with response time of less than 5 msec, conductance of C_v exceeding 1 and cycle lifetime exceeding 10 million cycles at less than 100 msec at operating temperature in excess of 150°C.

131. A fail-safe normally closed (FSNC) pneumatically actuated valve with response time of less than 5 msec; conductance of C_v exceeding 2 and cycle lifetime exceeding 10 million cycles at less than 100 msec at operating temperature in excess of 150°C.

132. A fail-safe normally closed (FSNC) pneumatically actuated valve with response time of less than 5 msec, conductance of C_v exceeding 0.5 and cycle lifetime exceeding 50 million cycles at less than 100 msec at operating temperature in excess of 150°C.

133. A fluid control valve comprising:

a valve port;

a mechanical valve actuator movable between a closed valve position and a open valve position;

a valve actuator driver for driving said mechanical valve actuator from said closed valve position to said open valve position;

a pneumatic valve driver for pneumatically opening and closing said valve port when said mechanical valve actuator is in said open valve position.

134. A fluid control valve as in claim 133 and further including a valve diaphragm located between said valve port and said mechanical valve driver.

135. A fluid control valve as in claim 134 wherein said pneumatic valve driver acts directly on said valve diaphragm.

136. A fluid control valve as in claim 133 wherein said valve actuator driver comprises a pneumatic actuator.

137. A fluid control valve as in claim 133 wherein said mechanical valve actuator comprises a spring.

138. A fluid control valve comprising:

a valve port;

a mechanical valve actuator movable between a closed valve closed position and an active valve position;

a valve actuator driver for driving said mechanical valve actuator from said closed valve position to said open valve position;

a pneumatic valve driver for pneumatically opening and closing said valve port when said mechanical valve actuator is in said active valve position.

139. A method of operating a fluid control valve comprising:

mechanically holding said valve closed in an inactive state in which it cannot be operated pneumatically;

changing said valve to an active state in which it can be opened and closed pneumatically; and

opening and closing said valve pneumatically.

140. A method as in claim 139 wherein said changing comprises pneumatically actuating a mechanical valve actuator.

141. A method as in claim 139 wherein said mechanically holding comprises holding said valve closed with a spring.

142. A method of operating a fluid control valve comprising:

holding said valve diaphragm closed with a mechanical actuator;

releasing said mechanical actuator; and

opening and closing said valve diaphragm pneumatically.

143. A method as in claim 142 wherein said releasing is performed pneumatically.

144. A method as in claim 142 wherein simultaneous with said releasing, pneumatic pressure is substituted for mechanical pressure to hold said valve closed.

145. The fluid control valve as in claim 2 wherein said fluid feed line is supplied with pressurized fluid;

said pressurized fluid actuates said normally closed pneumatic actuator;

said actuated pneumatic actuator is repelled away from said diaphragm;

said pressurized fluid is disconnected from said valve control chamber when said pilot valve is actuated;

said control chamber is evacuated when said pilot valve is actuated; and

said diaphragm is flexibly snapped away from said valve seat to enable flow through said fluid control valve.

146. The fluid control valve as in claim 6 wherein said fluid feed line is supplied with pressurized fluid;

said pressurized fluid actuates said normally closed pneumatic actuator;

said actuated pneumatic actuator is repelled away from said diaphragm;

said pressurized fluid is disconnected from said valve control chamber when said pilot valve is actuated;

said control chamber is evacuated when said pilot valve is actuated; and

said diaphragm is flexibly snapped away from said valve seat to enable flow through said fluid control valve.

147. The fluid control valve as in claim 47 wherein said fluid feed line is supplied with pressurized fluid;

said pressurized fluid actuates said normally closed pneumatic actuator;

said actuated pneumatic actuator is repelled away from said bellow;

said pressurized fluid is disconnected from said valve control chamber when said pilot valve is actuated;

said control chamber is evacuated when said pilot valve is actuated; and

said bellow is flexibly snapped away from said valve seat to enable flow through said fluid control valve.

148. A fluid control valve, comprising:

a valve body wherein an inlet and an outlet ports are formed;

a valve camber bottom portion formed in said valve body wherein a first of said ports is connected in serial fluidic communication into said valve bottom portion substantially at the center of said valve chamber bottom portion;

a second of said ports is connected in serial fluidic communication into said valve bottom portion substantially off the center of said valve chamber bottom portion;

a valve seal is located inside said valve chamber bottom around said first port;

a valve chamber top portion made from a substantially flexible member;

the center of said substantially flexible member is normally positioned substantially separated from said valve chamber bottom portion;

said valve chamber top separates said valve chamber from a valve control chamber;

said valve control chamber comprises a fluid connection port;

said valve control chamber comprises a translatable stem;

said translatable stem is actuated by pressurized fluid means through a fluid feed line;

said fluid connection port is connected in serial fluidic communication with said fluid feed line;

a pilot control valve is connected in serial fluidic communication between said fluid feed line and said fluid connection port;

the fluid path in said pilot control valve normally connects the fluid from said fluid feed line to said fluid connection port;

said fluid path in said pilot valve disconnects the fluid from said fluid feed line to fluid connection port when actuated and connects said fluid connection port to an evacuation line when actuated;

said valve stem is normally compressed with a spring to push and deflect said flexible member between said valve chamber and said control chamber to conform and substantially seal over said valve seal; wherein

a fluid is applied through fluid feed line to actuate said valve stem to translate away from said flexible member between said valve chamber and said control chamber;

said fluid is applied into said valve control chamber through said pilot valve when said pilot valve is not actuated to deflect said flexible member between said valve chamber and said control chamber to conform and substantially seal over said valve seal;

said fluid is evacuated out of said valve control chamber when said pilot valve is actuated;

said flexible member returns to a free-standing position when said pilot valve is actuated; and

said fluid control valve is open.

149. A fluid control valve comprising:

a valve seat;

a flow path through said valve seat

a flexible member 62;

a pneumatic actuator 64;

a flexible member chamber 54;

a flexible member chamber evacuation port 56; and

an evacuation line 70;

wherein said flexible member is dispersed between said valve seat and said flexible member chamber;

said pneumatic actuator is configured to close said flow path by deflecting said flexible member to seal over said valve seat;

said flexible member chamber is pressure sealed; and

said flow path remains pressure sealed from the ambient when a flexible member failure occurs.

150. The fluid control valve of claim 149, wherein said flexible member comprising a metallic diaphragm.

151. The fluid control valve of claim 149, wherein said flexible member comprising a metallic bellow.

152. The fluid control valve of claim 149, wherein said flexible member chamber is further evacuated following a failure of said flexible member.